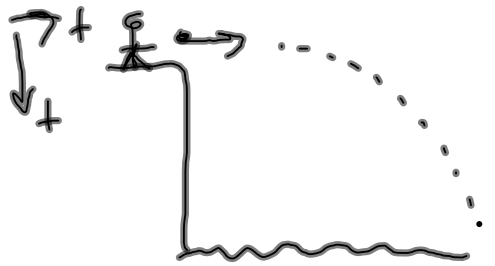
Quarter Exam Review 3.19.12 CP Physics

A person is standing of the edge of a cliff, which is 200 m high. The person throws a stone horizontally off the cliff at 12 m/s.
a) How long does it take for the stone to reach the water below?
b) How far does it go in the x-direction?



$v_{ix} = 12\ m/s \quad \Delta y = 200\ m$

$v_{iy} = 0\ m/s \quad \Delta x = ?$

$a_x = 0\ m/s^2 \quad t = ?$

$a_g = 9.8\ m/s^2$

a) $\Delta y = v_{iy}t + \frac{1}{2}a_g t^2$

$t = \sqrt{\frac{2\Delta y}{a_g}}$

$= \sqrt{\frac{2(200\ m)}{9.8\ m/s^2}}$

$= 6.38\ s$

b) $\Delta x = v_{ix}t$

$= (12\ m/s)(6.38\ s)$

$= 76.8\ m$

Projectile Motion:

- Assumptions:

  1. Acceleration in x-direction equals zero.

     (object does NOT change velocity in the x-direction)

  2. Free-fall in the y-direction, meaning that the only acceleration is a_g.

     (object WILL change velocity in the y-direction)

- Problem types:
  - Cliff (changing Δy)
  - Golf ball (not changing Δy → ball starts and finishes at the same height)

A golf ball is hit at a velocity of 45 m/s at an angle of 35 degrees.
a) If the golf ball goes a distance of 300 m, how long is the ball in the air?
b) How high does the ball go in the air?

$$v_{ix} = v_i \cos(35°)$$
$$= 36.8 \text{ m/s}$$

$$v_{iy} = v_i \sin(35°)$$
$$= 25.8 \text{ m/s}$$

a) $\Delta x = 300$ m $\quad v_{ix} = 36.8$ m/s $\quad t = ?$

$$\Delta x = v_{ix} t$$
$$t = \frac{\Delta x}{v_{ix}} = \frac{300 \text{ m}}{36.8 \text{ m/s}} = 8.15 \text{ s}$$

b) highest point occurs at $\frac{1}{2}t$ for this type of problem

y-velocity at highest point = 0 m/s

$$v_{fy}^2 = v_{iy}^2 + 2a_g \Delta y \qquad (a_g = -9.8 \text{ m/s}^2)$$
or
$$\Delta y = v_{iy} t + \frac{1}{2} a_g t^2$$

$$v_{fy}^2 = v_{iy}^2 + 2a_g \Delta y$$

$$\Delta y = \frac{-v_{iy}^2}{2a_g}$$
$$= \frac{-(25.8 \text{ m/s})^2}{2(-9.8 \text{ m/s}^2)}$$
$$= 33.96 \text{ m}$$

$$\Delta y = v_{iy} t + \frac{1}{2} a_g t^2$$
$$= (25.8 \text{ m/s})(4.08 \text{ s}) + \frac{1}{2}(-9.8 \text{ m/s}^2)(4.08 \text{ s})^2$$
$$= 23.7 \text{ m}$$

Different b/c of my made-up numbers. It WILL work on the test.

Impulse-Momentum theorem:

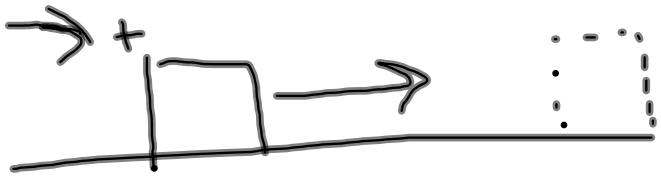
impulse = change in momentum

$$\bar{F} = \Delta \bar{p}$$

$$\bar{F}\,\Delta t = m\,\Delta \bar{v}$$

$$\bar{F}\,\Delta t = m\left(\bar{v}_f - v_i\right)$$

A 25 N force is applied to a box for 10 s. It has a mass of 10 kg, and has an initial velocity of 4 m/s. What is the box's final velocity after the 10 s?



$F = 25\,N \quad t = 10\,s \quad m = 10\,kg$

$v_i = 4\,m/s$

$$\bar{F}\,\Delta t = m\,\Delta \bar{v}$$

$$F\,\Delta t = m\,(v_f - v_i)$$

$$v_f = \frac{F\,\Delta t}{m} + v_i$$

$$= \frac{(25\,N)(10\,s)}{10\,kg} + 4\,m/s$$

$$= 29\,m/s$$